Switchgear assembly system and method for installation
of withdrawable units in switchgear assemblies

5   Description

The invention relates to a switchgear system and to a
method for installation of withdrawable units in
switchgear assemblies, in particular in low-voltage
10   switchgear assemblies, and to a withdrawable unit.

Switchgear assembly systems, in particular low-voltage
switchgear assemblies, using withdrawable insert
technology are known in principle and are marketed by a
15   number of manufacturers using different product brand
names, for example SIEMENS using the name SIVACON with
the withdrawable unit Simocode DP or by ABB using the
name MNS with the withdrawable unit INSUM.

20   In this case, very widely different low-voltage
switching devices are nowadays combined, installed and
connected to one another in inserts, thus resulting in
modular withdrawable units, which are also referred to
here as appliances. A number of appliances communicate
25   via a field bus, which is also referred to for short in
the following text as a bus. Each of these
communicating appliances is provided by means of a
configuration tool with a unique address, in order to
allow communication. The address is stored in a non-
30   volatile form in the appliance, to be precise according
to the prior art either being set manually by means of
dip switches or being set in a non-volatile electronic
memory.

35   In addition, further basic information which is
required for operation also referred to in the
following text as appliance data, is stored in a non-
volatile form in the appliance. This data may, for

example, be limit values which have to be monitored or complied with, or critical time parameters or parameters for the bus protocol.

5   When a new appliance is connected to the bus, the appliance address which prevents confusion about the appliance and allows it to be identified in the bus system, must first of all be programmed using a configuration tool. This must be done first of all
10 before the bus connection can be set up and the appliance data can be loaded into the appliance, using a further tool.

When an appliance is replaced, the appliance data must
15 first of all be read with the aid of tools and must be temporarily stored outside the switchgear assembly, before the new appliance is physically installed, the address is allocated and the new appliance can once again be loaded with the appliance data from the
20 temporary store, as described above.

Thus, when withdrawable units are installed according to the prior art in switchgear assemblies, extensive manual actions are required in order to carry out the
25 necessary operations, and additional appliances and software programs are required, that have to be controlled manually.

Against the background of the prior art as described
30 above, the object of the present invention is thus to provide a switchgear assembly system and a method which considerably simplifies the installation of withdrawable units in switchgear assemblies.

35 The object is achieved by the characterizing features of claim 1 with regard to the switchgear assembly system, and by the characterizing features of claim 10 with regard to the method.

Thus, according to the invention, at least one withdrawable unit in a switchgear assembly communicates with the field bus by means of the Ethernet TCP/IP technology, and the at least one withdrawable unit has a TCP/IP interface.

TCP/IP is a specific type of bus protocol which originates from Internet technology, where it is also used. Ethernet is a type of bus that can be used for industrial purposes.

In one highly advantageous embodiment of a system according to the invention, at least one Ethernet switch, with which the at least one withdrawable unit communicates, is fitted in each switchgear cabinet. Furthermore, an application server is provided in the Ethernet network and manages at least the TCP/IP address allocation, and a database is provided, in which at least appliance data for the at least one withdrawable unit is at least stored and/or managed. The mechanisms which are used in this case for address allocation by an application server, also referred to as DHCP server, are in this case known per se in the prior art.

According to one particularly advantageous refinement of the invention, each insert compartment - also referred to as an installation slot in the following text - is allocated a unique port of the Ethernet switch. In this case, a plurality of insert compartments or installation locations can be arranged on one level within the switchgear cabinet.

A further advantageous refinement option of the invention provides that the database contains, at least for each withdrawable unit, at least information relating to its installation location and to its

intended application. Information relating to the installation location may in this case advantageously be details relating to the Ethernet switch and to the port of the Ethernet switch to which the withdrawable
5 unit is allocated. Application-related information advantageously includes a unique application identification and associated appliance data.

Systems designed according to the invention are
10 distinguished in that appliance data can be interchanged between the database and a withdrawable unit via the application server.

It is particularly advantageous for the application
15 server to contain appliance identification software for identification of an appliance which is allocated to a port of an Ethernet switch. In this case, the appliance identification software can identify the appliance type of an appliance which is allocated to one port of an
20 Ethernet switch. The appliance identification software can advantageously also control the interchange of appliance data between the database and a withdrawable unit via the application server.

25 With regard to the method for installation of withdrawable units in switchgear assemblies, the invention comprises the communication via the field bus being based on Ethernet TCP/IP technology, and the appliance addresses for the withdrawable units being
30 allocated to them and managed automatically by an application server which is integrated in the Ethernet network, with at least the basic information for each withdrawable unit being automatically downloaded from a database to the withdrawable unit.
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In this case, it is particularly advantageous for the appliance addresses to be allocated automatically to the withdrawable units during or after the installation

in the cabinet of the switchgear assembly, and/or for the basic information to be downloaded automatically into the withdrawable units during or after the installation of the withdrawable units in the
5   switchgear cabinet. This is because there is no longer any need for manual actions on the withdrawable units before their insertion into their intended installation location, thus considerably simplifying the installation process.
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It is particularly advantageous for at least the basic information for each withdrawable unit to be downloaded from the database via the application server. It is also advantageous, in addition to the basic
15   information, for further application and appliance information for at least one withdrawable unit also to be automatically downloaded from the database into the withdrawable unit.

20   In addition, in one very advantageous refinement, the withdrawable units in the switchgear cabinet communicate by TCP/IP with an Ethernet switch which is allocated to that switchgear cabinet. Each switchgear cabinet level and/or the installation location of each
25   withdrawable unit is then advantageously allocated a unique port of the Ethernet switch in the switchgear cabinet.

One advantageous refinement of the method according to
30   the invention is characterized in that appliance data for all the switchgear assembly appliances is managed in the database. Information about the use of the withdrawable unit and the basic information required for this purpose are then stored together with the
35   information about its installation location in an advantageous manner for each withdrawable unit.

A further highly advantageous refinement of the

invention provides for the appliance type of a
withdrawable unit to be identified automatically by the
appliance server during its installation at an
installation location in the switchgear cabinet. The
5   software in the application server contains appropriate
suitable program parts and/or routines for this
purpose. The appliance data in the database is in this
case automatically checked for compatibility with the
appliance type identified by the application server. If
10 no match is found, then the appliance data is not
automatically loaded; instead of this, a message is
emitted, thus providing good protection against
confusion between appliances.

15 Overall, the advantage of the method according to the
invention is that there is no need for appliance
addresses and/or appliance data to be read in, read out
or interchanged manually either during installation of
a new withdrawable unit in a switchgear cabinet or
20 during replacement of a withdrawable unit, for example
in the course of maintenance work. The withdrawable
unit is now just plugged into its intended installation
location, and is thus physically connected to the
Ethernet field bus system. The rest of the logical
25 installation of the withdrawable unit is carried out
automatically after this, without any manual action.

However, an even more advantageous variant of the
invention provides for the capability for each method
30 step nevertheless to be monitored and/or carried out
manually when desired by the user or operator.
Intervention by a human operator is therefore always
still possible as a safety precaution in the event of
an emergency.
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A withdrawable unit according to the invention for
installation in a switchgear assembly is characterized
in that the field bus communication of the withdrawable

unit is based on Ethernet TCP/IP technology, with the withdrawable unit containing at least one Ethernet TCP/IP interface.

5   Further advantageous refinements and improvements of the invention and further advantages can be found in the dependent claims.

The invention as well as further advantageous
10   refinements and improvements of the invention will be explained and described in more detail with reference to the single figure, which illustrates one exemplary embodiment of the invention.

15   The figure shows a switchgear cabinet 10 which is part of a switchgear assembly that is not illustrated here. The switchgear cabinet 10 contains four installation locations 12, 14, 16, 18 for withdrawable units, one withdrawable unit 11 of which is illustrated here in a
20   representative form. The installation locations 14 and 16 are in this case arranged on one level within the switchgear cabinet 10. The switchgear cabinet 10 also contains an Ethernet switch 20 which has as many ports 13, 15, 17, 19 as there are installation locations 12,
25   14, 16, 18 in the switchgear cabinet. Each of the ports 13, 15, 17, 19 is connected to one and only one respective installation location 12, 14, 16, 18. The installation locations 12, 14, 16, 18 of the Ethernet switch 20 with the ports 13, 15, 17, 19 and the
30   connecting lines between the ports 13, 15, 17, 19 and the installation locations 12, 14, 16, 18 are part of an Ethernet TCP/IP-based field bus system.

By way of example, the withdrawable unit 11 is a motor
35   protective circuit, which is inserted into the installation location 12 in the direction of the arrow P, for installation. While being inserted, the electrical connection with the Ethernet TCP/IP-based

bus system is made via plug contacts on the narrow face of the withdrawable unit 11, facing the installation location 12.

5   The parts of the Ethernet TCP/IP-based field bus system also include an application server 30 and a database 40. The application server 30 is connected to the Ethernet switch 20 in the switchgear cabinet 10. The database 40 is connected to the application server 30,
10   and is connected indirectly via this application server 30 to the Ethernet switch 20 in the switchgear cabinet 10.

Other parts and subsystems of a field bus system, such
15   as a field bus controller or other bus subscribers, are not shown here, for the sake of clarity of the illustration.

The communication between all the involved appliances
20   via the field bus is based on Ethernet TCP/IP technology. The mechanisms used for address allocation by a DHCP server are prior art. The application server 30 which is integrated in the Ethernet network operates as a DHCP server, that manages the TCP/IP address
25   allocation.

In addition, appliance data for at least the withdrawable units is stored and managed in the database 40. In this case, the database 40 contains at
30   least the following appliance-related information: a unique application identification of the appliance, for example the identification from the power station identification system (KKS) when the switchgear assembly is used in a power station, further appliance
35   data and information relating to the installation location, for example the switchgear cabinet (Ethernet switch) and installation location (port of an Ethernet switch) in which the appliance is installed. In the

case of the motor protective circuit 11, further
appliance data such as this includes, for example,
current or temperature limit values or disconnection or
tripping times that are not to be exceeded.

The withdrawable units 11 in their installation
locations 12, 14, 16, 18 in the switchgear cabinet 10
first of all communicate via Ethernet TCP/IP with the
Ethernet switch 20 allocated to that switchgear cabinet
10. This Ethernet switch 20 and the higher-level
Ethernet network topology may be of redundant design.

Each installation location 12, 14, 16, 18 in the
switchgear cabinet 10 is allocated a unique port of the
Ethernet switch 20, in this case the installation
location 12 being allocated the port 13, the
installation location 14 the port 15, the installation
location 16 the port 17 and the installation location
18 the port 19.

When a new appliance, for example the motor protective
circuit 11, is inserted into an installation location,
in this case the installation location 12, in the
switchgear assembly 10, the application server 30
identifies that an appliance has been inserted into an
installation location, and which installation location
it has been placed in. The application server 30 then
automatically allocates a TCP/IP address to that
appliance.

A software program in the application server 30
identifies the new appliance, and loads the application
associated with that installation location, and the
required appliance data, from the database 40 via the
application server 30 into that appliance. During this
process, the field bus system ensures that the up to
date appliance data is always available in the database
40.

In addition, the software can identify what type of
appliance has been inserted, for example a motor
circuit breaker, a motor starter or a fuse strip. A
5   check is then carried out to determine whether the
application and/or the appliance data which are/is
stored in the database relating to this appliance also
match/matches this appliance type. If no match can be
found, the application is not automatically loaded, and
10   a message is emitted. This ensures effective protection
against confusion between withdrawable units.

If an appliance, for example the motor protective
circuit 11 is now removed from the switchgear assembly
15   10, the application server 30 stores the information
that an appliance has been removed, and which appliance
has been removed, in the database 40. There is no need
to read the appliance data back manually.

20   When an appliance is inserted again, then a check is
carried out once the TCP/IP communication has been set
up again to determine whether this is the appliance
which was previously removed from this installation
location and thus whether its installation-location-
25   dependent application is still available. In this case,
the application server will not download any new
appliance data from the database 40. However, if the
check shows that the appliance that has been inserted
is a new appliance, then its appliance data is loaded
30   into the appliance from the database 40 via the
application server 30.

There is no need for any manual actions in order to
initiate or to carry out the procedures described above
35   of address allocation, address management and the
transfer of appliance data to the appliance. The
withdrawable unit is now just inserted into its
intended installation location, and is thus physically

connected to the Ethernet field bus system. The rest of
the logical installation of the withdrawable unit is
then carried out automatically without any manual
action. If required, however, each method step can
5   nevertheless be monitored and/or carried out manually,
if desired by the user or operator. Intervention by a
human operator is thus always still possible as a
safety precaution in the event of an emergency.